GEOLOGIC MAPPING OF ATHABASCA VALLES. L. P. Keszthelyi[1], W. L. Jaeger[1], K. Tanaka[1], and T. Hare[1], [1]U.S. Geological Survey, Astrogeology Team, 2255 N. Gemini Dr., Flagstaff, AZ 86001.

Introduction: We are approaching the end of the second year of mapping the Athabasca Valles region of Mars. The bulk of the linework has been completed and we are on schedule to submit the 4 MTM quads (05202, 05207, 10202, 10207) and accompanying paper by the end of the 3rd (and final) year of funding.

Previous Work: The study area is of special interest for several reasons: (a) it is central to the controversial and now disproven "Elysium Sea" [1,2]; (b) it is the location of the best preserved outflow channel [2-4]; (c) it also covers the confluence of lavas from the Elysium rise, multiple small vents, and vast flood lavas [5-8]; (d) and it contains the long-puzzling Medusae Fossae Formation (MFF). Moreover, the remnant knobs of ancient highlands in this region may help constrain the current nature of the Highlands-Lowlands Boundary (HLB).

Mapping Methodology: Two factors drive us to map the Athabasca Valles area in unusual detail: (1) the extremely well-preserved and exposed surface morphologies and (2) the extensive high resolution imaging. In particular, the near-complete CTX coverage of Athabasca Valles proper and the extensive coverage of its surroundings have been invaluable.

The mapping has been done exclusively in ArcGIS, using individual CTX, THEMIS VIS, and MOC frames overlying the THEMIS IR daytime basemap. MOLA shot points and gridded DTMs are also included. It was found that CTX images processed through ISIS are almost always within 300 m of the MOLA derived locations, and usually within tens of meters, with no adjustments to camera pointing. THEMIS VIS images appear to be systematically shifted to the southwest of their correct positions and MOC images are often kilometers off. The good SNR and minimal artifacts make the CTX images vastly more useful than the THEMIS VIS or MOC images.

The bulk of the mapping was done at 1:50,000 scale on CTX images. In more complex areas, mapping at 1:24,000 proved necessary. The CTX images were usually simultaneously viewed on a second monitor using the ISIS3 qview program to display the full dynamic range of the CTX data. Where CTX data was not available, mapping was often done at 1:100,000 and most contacts are mapped as approximate.

The Expected: Jaeger et al. [2] showed that Athabasca Valles is coated by a thin layer of lava left behind after an extremely voluminous flow passed through it. The mapping provides the detailed observations that back up the statements in [2] that the lavas then filled Cerberus Palus and drained through smaller channels to the southeast and southwest. We also detail the multiple lava sources along the Cerberus Fossae and the array of distributaries that fed lava beyond Athabasca Valles proper. As indicated in [2], the lava coats all possible locations of flood sediments. This flood lava is a proper lithochronologic unit that we have called the Athabasca Valles Lava (Aav).

The various sheet flows show the expected morphologic transitions from drained channels near-vent to platy-ridged surfaces in the medial portion to inflated pahoehoe at the distal margins. The most difficult contacts to identify are where the marginal inflated pahoehoe from different eruptions intermingle.

The Unexpected: The most surprising aspect of the Athabasca Valles Lava is the exposure of young lava, indistinguishable from Aav, in a window through the MFF. This suggests that some parts of Aav may have been exhumed from underneath ~100 m of mantling deposits. There is also a lobe of young flood lava in the southeastern part of the map whose source may be buried underneath the MFF.

Some of the tectonic features in the study area record young deformation. Near the northern limit of Aav, a lava-coated channel cuts into, and is cut by, the same strand of the Cerberus Fossae. Similarly, a wrinkle ridge near the western edge of the mapped extent of Aav is coated by lava but also appears to have deformed it.

There are fewer craters than might be expected on the knobs mapped as remnant ancient highlands. Part of this is undoubtedly due to the steep slopes with active mass wasting that quickly erases small (<1 km diameter) craters.

Remaining Work: The major mapping tasks that remain are (1) adding geologic structures, especially fissures and wrinkle ridges, (2) attempting to subdivide the Elysium rise lavas which exhibit may distinct lobes, (3) refining the correlations between the young lavas underneath Aav, (4) finish mapping the small craters and other km-scale features, (5) correlation of map units and description of map units, and (6) JGR/Icarus manuscript preparation.

References: [1] Murray J. B. et al. (2005) *Nature, 434*, 352-356. [2] Jaeger W. L. et al. (2007) *Science, 317*, 1709-1711. [3] Tanaka and Scott (1986) *LPS XVII*, 865. [4] Burr D. M. et al. (2002) *Icarus, 159*, 53-73. [5] Plescia J. B. (1990) *Icarus, 88*, 465-490. [6] Lanagan P. D. (2004) *Ph.D Thesis*, Univ. Arizona. [7] Keszthelyi, L. et al. (2004) *G^3*, 5, 2004GC000758.

Figure 1. Draft geologic map of the Athabasca Valles region of Mars. Transverse Mercator projection with center longitude of 150° E, center latitude of 0°. Latitude range is 2.4-12.6° N, longitude range is 149.9-160.1° E.